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The Crimped Bovine Pericardium Bioprosthesis in Graft Infection: Preliminary Experience

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Introduction

Aortofemoral graft infection is a rare but life-threatening complication of abdominal aortic surgery which develops in about 0.7–2.8%.[1–6] Once occurred, the graft infection presents a very high mortality rate (14–55%),[1,3] in particular in those cases who present secondary aortoenteric fistula. After removal of an infected aortic graft, distal revascularisation can be obtained with a new graft in an anatomic (*in situ* revascularisation) or extra-anatomic position.[7–9] Among the available grafts, biological prostheses seems to possess higher infection resistance.[9–15] In 1987, Salles *et al.*[16] developed a new bovine pericardial conduit introducing the principle of crimping used for Dacron vascular prostheses. They used this conduit, after experimental studies, for replacement of the thoracic and abdominal aorta as well as to correct different kinds of complex congenital cardiac lesions. The crimped bovine pericardium conduit is obtained after a complex process. The resultant graft is a soft and flexible tube, fashioned in a straight or bifurcated design, easy to handle and suture in aortic position.

We started to use the bifurcated crimped bovine pericardium conduit in the revascularisation of ischaemic areas after the removal of an infected aortofemoral graft from 1993. The purpose of this paper is to assess whether there is a role for this biological compound in the management of graft infection.

Materials and Methods

From January 1991 to November 1995 we performed 3542 arterial reconstructions with 639 grafts implanted in aortic position, 566 (88.6%) for aortic aneurysm and 73 (11.4%) for aortic occlusion. Twenty patients with aortofemoral graft infection (3.1% of the aortic surgery) underwent removal of the infected graft. There were 19 men and one woman, with a mean age of 62 years (range 42–77).

The clinical presentation of these 20 cases was an aortoenteric fistula in 12 cases (63%), seven (37%) melaena, six (31%) hypovolaemic shock, five (26%) an inguinal fistula, four (21%) inguinal abscess, three (16%) a retroperitoneal abscess, three (16%) a femoral pseudoaneurysm and two (10%) an aortic pseudoaneurysm. In the inguinal area the isolated bacteria were *Staphylococcus aureus* in nine cases, *Pseudomonas aeruginosa* in one, while in the abdominal area were Gram-negative in the majority of the cases. All the removed grafts were Dacron.

The previous vascular reconstruction was an aortobifemoral graft in 12 cases (60%), a terminoterminal aortic replacement in three cases (15%), an aortobiiliac replacement in two cases (10%), an aortomonofemoral in one case (5%) and a femorofemoral crossover bypass in two cases (10%). The patients were divided into two groups: (1) group A—12 patients (60%) with aortoenteric fistula; (2) group B—eight patients (40%) without aortoenteric fistula. The surgical techniques adopted in the two groups of patients are shown in Tables 1 and 2. In group A patients the total removal of the infected graft was followed by extra-anatomical (axillobifemoral) bypass in five cases, and by *in situ* revascularisation in four cases. In three patients this was the only surgical procedure. In group B patients this was performed in three cases, a partial removal of the graft followed by *in situ* reconstruction in two cases and by extra-anatomic (transobturatory) bypass; in five cases an aortobifemoral *in situ* reconstruction followed the total removal.

The *in situ* revascularisation was performed in nine cases. In five cases was adopted the crimped bovine

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Table 1. Surgical treatment in group A patients (with aortoenteric fistula).

	No.	Previous reconstruction	Mortality
Total removal	3	2 AOBF	2
		1 AOMF	—
Total removal + EABP	5	3 AOAO	2
		1 AOBI	1
		1 AOBF	—
Total removal + alloplastic *in situ*	1	1 AOBF	—
Total removal + bovine pericardium *in situ*	2	2 AOBF	1
Total removal + homograft *in situ*	1	1 AOBF	—

EABP = extranatomical bypass; AOBF = aortobifemoral bypass; AOAO = aortic replacement; AOBI = aortobi-iliac replacement.

Table 2. Surgical treatment in group B patients (without aortoenteric fistula).

	No.	Previous reconstruction	Mortality
Partial removal + reconstruction:	3		—
—*In situ*	2	1 AOBI	
		1 AOBF	
—Extra-anatomical	1	1 AOBF	
Total removal + bovine pericardium *in situ*	3	1 AOBF	1
		2 FEFE	—
Total removal + homograft *in situ*	2	2 AOBF	—

AOBI = aortobi-iliac replacement; AOBF = aortobifemoral bypass; FEFE = femorofemoral bypass; Extra-anatomical = transobturatory bypass.

pericardium conduit was adopted (see patient list in Table 3) (two in group A and three in group B), in three cases an homologous aorta from multi-organ donor (one in group A and two in group B), and in one case an alloplastic graft (in group A).

Results

The global mortality of the series was 35% (seven patients) and the major leg amputation rate was of 15% (three cases). In the two groups the results were different with a mortality of 50% (six patients) in group A and of 12.5% (one patient) in group B. This second group, however, included all the amputations (three patients: 37.5%).

Comparing the mortality with the surgical technique adopted it was evident that, in group A, the total

Table 3. Crimped bovine pericardium conduits: clinical cases.

Patient	Sex	Age	Diagnosis	Operation	Outcome
1	M	62	—INF.AOBF —ING.ABSC. —AEF	TOT.REM. + *in situ*	Good
			Bacteria: *Staphylococcus, coagulase-negative*		
2	F	68	—INF.AOBF —ING.ABSC	TOT.REM. + *in situ*	Died
			Bacteria: *Salmonella arizonae*		
3	M	58	—INF.FEFE —ULC.INF.LEG	TOT.REM. + *in situ*	Good
			Bacteria: *Staphylococcus haemolyticus*		
4	M	59	—INF.AOBF —AEF	TOT.REM. + *in situ*	Died
			Bacteria: *Escherichia coli* + *Staphylococcus, coagulase-negative*		
5	M	76	—INF.FEPOP. —Septicaemia	TOT.REM. + *in situ*	Good
			Bacteria: *Pseudomonas*		

INF. = infected; AOBF = aortobifemoral bypass; FEFE = femorofemoral bypass; ING.ABSC. = inguinal abscess; ULC.INF.LEG = ulceration inferior leg; AEF = aortoenteric fistula; TOT.REM. + *in situ* = total removal of the graft and *in situ* revascularisation with crimped bovine pericardium conduit; FEPOP-femoro-popliteal bypass.

removal of the infected graft associated or not with an extra-anatomic bypass was affected with a high mortality (five patients: 62.5%), while the *in situ* revascularisation presents a lower mortality (one patient: 25%).

The *in situ* crimped bovine pericardium group was affected by a mortality of 40% (two patients: one in group A and one in group B). The cause of death was the recurrence of infection (group B patient) and a late failure of the duodenal suture (group A patient).

The 13 survivors were followed up for a mean period of 18 months (range 1–36). During this period one group A patient died from a myocardial infarction and three group B patients were readmitted for recurrent infection.

Discussion

The treatment of choice in aortofemoral graft infection is controversial.[4,5,7,9–13] None of the proposed techniques is universally accepted, with results varying greatly among different surgeons. In the last decade, various authors[9–13,15] have utilised biological prostheses in the management of graft infection. Reports suggest that biological grafts seem to have higher infection resistance compared with prosthetic material.[14,15] Among these authors, Kieffer[9,15] has had good results with the use of fresh human homograft harvested from multi-organ donors and implanted in the infected fields.

Together with other surgical departments, we started

a program for the use of human arterial homograft but due to logistic and bureaucratic problems it is not always possible to have an arterial homograft available, especially in emergency situations. In these conditions the crimped bovine pericardium conduit represents an alternative substitute biological graft material.

The number of grafts implanted and of patients in this group is too small to be statistically significant. In particular the follow-up period is too short to consider the real risk of infection recurrence and the biological resistance to the infection. However, the results of the series seem to suggest a possible role for this graft, as a bridge solution to the replacement of an alloplastic graft but also as a definitive solution. Further investigations will clarify those aspects.

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